~~November 9, 1999~~

What is claimed is

~~Patent Claims~~

1. A method for processing workpieces (20) by means of high-energy radiation, particularly by means of laser radiation (1), in which the radiation (1) is focused by a processing optic onto a processing site (40), in which the light radiation emanating from said workpiece (20) is received utilizing the processing optic and is analyzed by a detector (11) of a process monitoring system, and in which an optical measurement with respect to the surface of said workpiece is performed in a processing area of said workpiece (20) by means of an external source (32 to 34) of measuring light, utilizing measuring light reflected from said processing area, **characterized in that** the light radiation used for process monitoring and the reflected measuring light are detected utilizing the same processing optic.

2. The method as recited in claim 1, **characterized in that** said light radiation used for process monitoring and said reflected measuring light are detected, utilizing the same processing optic, isoaxially or approximately isoaxially with said light radiation or axially parallel thereto.

3. The method as recited in claim 1 or 2, **characterized in that** the optical measurement performed with respect to the workpiece surface is a measurement of the distance between the processing optic and said workpiece (20) and/or a mapping of the workpiece geometry before said processing site (40) and/or a mapping of the seam geometry present after processing and/or a mapping of the melt (23) produced at said processing site (40).

4. The method as recited in one or more of claims 1 to 3, **characterized in that** different zones (I, II, III) of said processing area of said workpiece (20) are detected by means of the same detector (11).

5. The method as recited in one or more of claims 1 to 4, **characterized in that** said first zone (I) of said processing area is taken to be the region of an interaction zone (22), said second zone (II), encompassing the first, is taken to be the region of the melt (23), and said third zone (III) is taken to be the processing area as a whole.

6. The method as recited in one or more of claims 1 to 5, **characterized in that** the sensing of different zones (I to III) of said processing area takes place simultaneously.

7. The method as recited in one or more of claims 1 to 6, **characterized in that** the light radiation used for process monitoring is secondary radiation from said interaction zone (22), and used as reflected measuring light is measuring light from regions of said processing area surrounding said interaction zone (22).

8. The method as recited in one or more of claims 1 to 7, **characterized in that** the sensing of said processing area as a whole is performed by means of a detector (11) with local resolution.

9. The method as recited in one or more of claims 1 to 8, **characterized in that** a detector (11) having linearly or areally arranged sensors is used.

10. The method as recited in one or more of claims 1 to 9, **characterized in that** all the sensors of said detector (11) read out for analysis the observation windows of at least two sensors forming zones (I, II or III) of said processing area.

11. The method as recited in one or more of claims 1 to 10, **characterized in that** observation windows are varied with respect to position and size on the basis of detector data and/or analysis of the results of optical measurements is suspended intermittently based on analytical data from said detector (11).

12. A device for processing workpieces (20) by means of high-energy radiation, particularly by means of laser radiation (1), comprising a processing optic that focuses the radiation (1) onto a processing site (40) and that detects the light radiation emanating from said workpiece (20) for a detector (11) of a process monitoring system having a predefined optical axis, and comprising an external measuring-light source (32 to 34) whose measuring light, reflected from a processing area of said workpiece (40), is used to perform an optical measurement at the surface of said workpiece, particularly to perform a method of claims 1 to 11, **characterized in that** said measuring light can be detected by means of the same processing optic.

13. The device as recited in claim 12, **characterized in that** said measuring light can be detected by means of said same processing optic within said predefined optical axis (10) of the light radiation emanating from said workpiece (20) or approximately isoaxially therewith or parallel thereto.

14. The device as recited in claim 12 or 13, **characterized in that** a single detector (11) is provided that is suitable for observing different zones (I to III) of said processing area of said workpiece (20), with local resolution if necessary.

15. The device as recited in one or more of claims 12 to 14, **characterized in that** a component decoupling said measuring light and/or said light radiation is disposed in the beam path of the high-energy or laser radiation (1).

16. The device as recited in one or more of claims 12 to 15, **characterized in that** said measuring-light source (32 to 34) is disposed inside a processing head comprising said processing optic.

17. The device as recited in one or more of claims 12 to 16, **characterized in that** said measuring-light source (32 to 34) is structurally combined with said decoupling component or is arranged spacedly in front of or behind said decoupling component.

18. The device as recited in one or more of claims 12 to 17, **characterized in that** said measuring light from said measuring-light source (32 to 34) is projected onto said workpiece (20) at an angle with respect to said predefined optical axis (10).

19. The device as recited in one or more of claims 12 to 18, **characterized in that** said measuring light from said measuring-light source (32 to 34) is projected onto said workpiece (20) as the envelope of a cone or truncated cone and/or as straight line segments.

20. The device as recited in one or more of claims 12 to 19, **characterized in that** said measuring light from said measuring-light source (32 to 34) is amplitude-modulated at a fixed frequency.

21. The device as recited in one or more of claims 12 to 20, **characterized in that** said measuring light from said measuring-light source (32 to 34) can be applied to different observation sites of said workpiece (20) in temporal succession with repetition at a high frequency.

22. The device as recited in one or more of claims 12 to 21, **characterized in that** said detector (11) has a dynamic range extending over plural decades of luminous or radiation intensity.

23. The device as recited in one or more of claims 12 to 22, **characterized in that** disposed ahead of said detector (11) is an optical filter system (12) possessing characteristics that delimit said observation zones (I, II or III) of said processing area.

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